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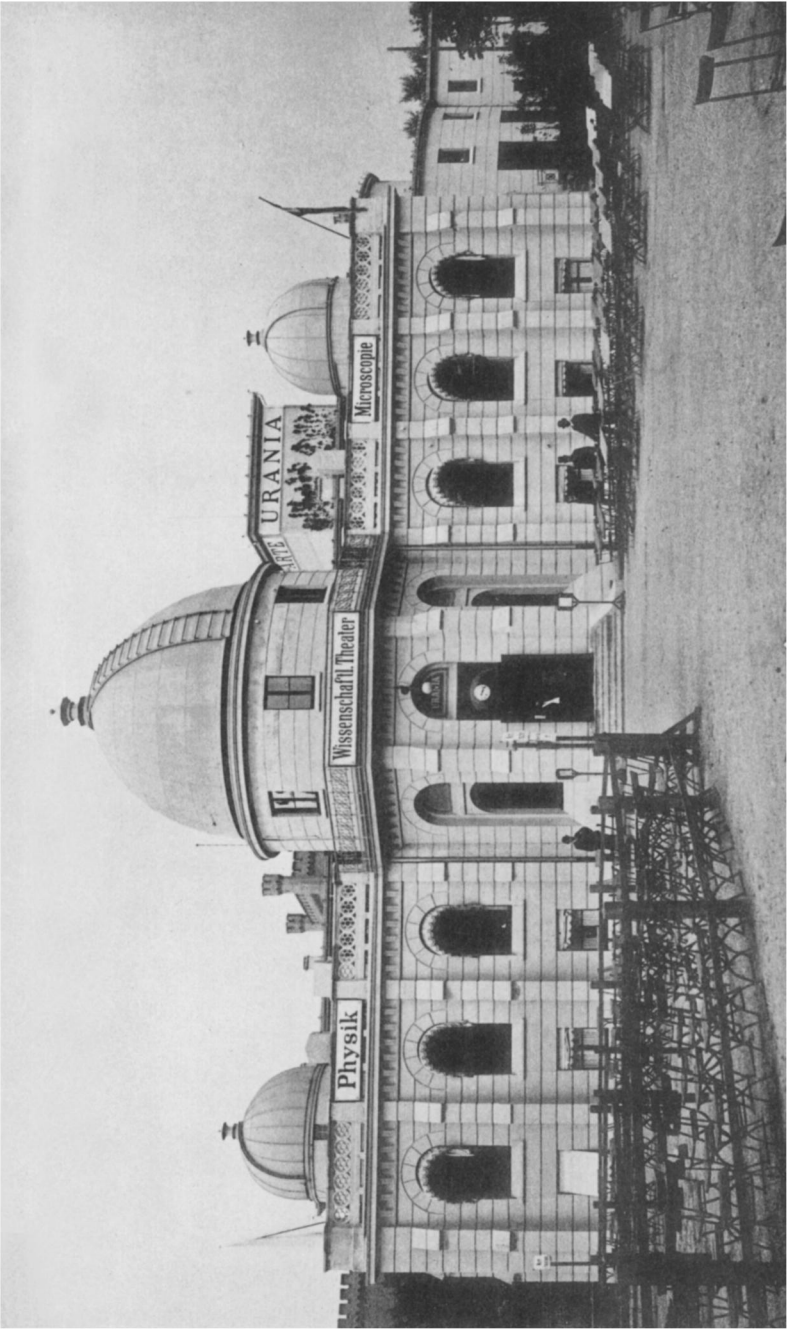
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No. 9.

THE URANIA GESELLSCHAFT.*

BY DR. M. WILHELM MEYER, DIRECTOR.

A few months ago *Himmel und Erde*, the journal published by the Urania Society, printed a most interesting description of the construction and scientific work of a great American observatory—of that observatory which is regarded by all astronomers of the world with a certain kind of envy, but at the same time with the pride which naturally results from the close association of the interests of all astronomers, of whatever nation; for we all know well that the possession of this great instrument of investigation, which had its origin in the munificence of a single individual, and has been so happily wrought out to completion, must advance the cause of astronomical science in every part of the world.

Professor EDWARD S. HOLDEN, the Director of the observatory referred to, has now, on his side, requested me to prepare an account of the founding of the Urania Institution, with which I have been closely connected from the very beginning, and which has been in close relations with the Lick Observatory from that time, since the two establishments have in many respects a similar aim. A further parallel can be drawn between the two institutions, namely: the Urania Institution, like the Lick Observatory, is devoted to the advance of scientific knowledge, although with less powerful appliances and instruments; it owes its origin to private capital, and depends for its support upon the interest of the great public in scientific investigations. It is with so much the greater pleasure therefore that I have prepared the following description of our own institution.

In view of the continually increasing interest which the public takes in the natural sciences and in their manifold applications to the affairs of every-day life, the founders of the Urania Institution long

* English translation by J. E. KEELER.

ago resolved to establish some popular scientific centre or building in which the desires of the people for increased knowledge in these directions could be satisfied. The original plan of Professor FOERSTER for a popular observatory, arising from the pressure of visitors at the Berlin Observatory (of which he is Director), and the consequent disturbance of the scientific work of the institution, was, by the advice of Dr. M. W. MEYER, the present Director of the new institute, so modified as to include physical, microscopical and other branches of natural science. An auditorium or scientific theatre, in which curious or remarkable natural phenomena could be presented to the public by the aid of scenic art, was also included in the plan.

The Prussian Minister of Public Instruction, Herr VON GOSSLER, at once took the warmest interest in the project, and placed the necessary site for the building at our disposal, in the park for the national exposition at Berlin.

On the 3d of March, 1888, the patrons of the new undertaking, at that time already numbering 122, met and formed a joint-stock company—but a stock company of such a remarkable character as has perhaps never before existed. The shares (each of 500 marks or about \$125) are not transferable, and they cannot be bought or sold. The object of the company is defined to be simply the diffusion of pleasure in the pursuit of the knowledge of Nature. Yearly dividends, not to exceed five per cent., may be paid, if justified by the financial success of the undertaking. Every member has the right of admission to all lectures or other entertainments, and receives free of charge the illustrated journal, *Himmel und Erde*, published monthly by the society. The available capital at the time of incorporation was about \$51,000, and has since been increased to \$100,000, while the number of members is now 375.

The Board of Directors is at present composed of the following members:

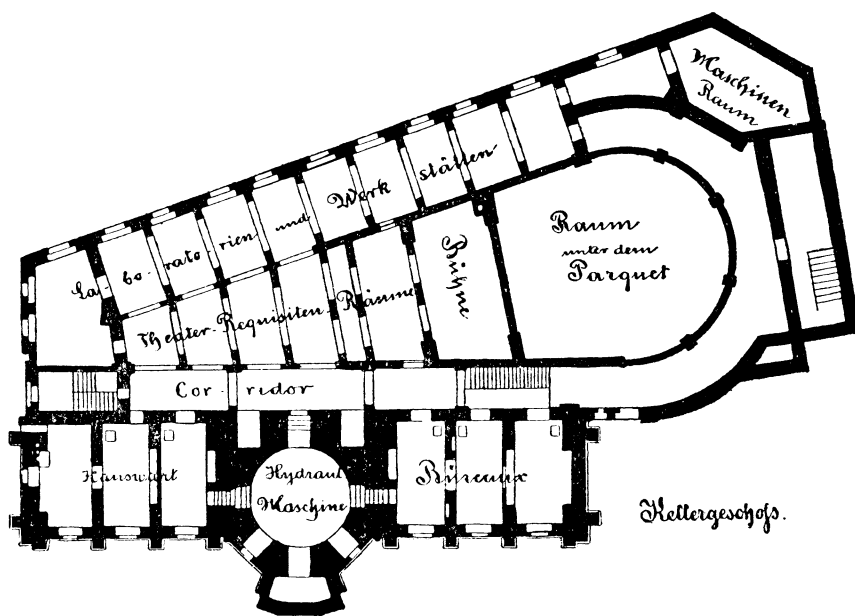
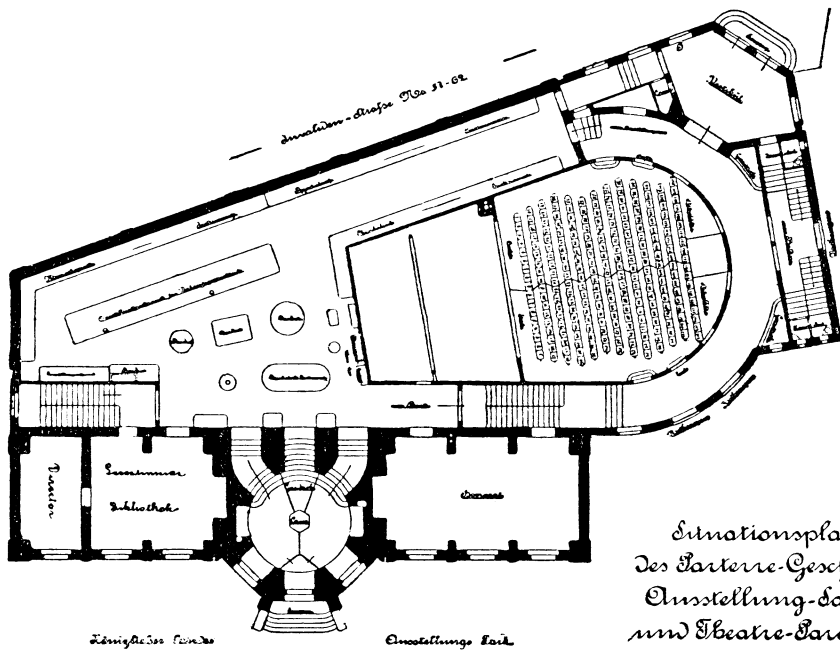
President, Professor H. LANDOLT; *Vice President*, Dr. H. PAETEL; Herr T. HEESE; H. HERZOG; Dr. M. MARCUSE; Herr T. SCHIFF; Herr W. VON SIEMENS; Herr W. ZWICKER.

The Council of the Society is composed of the following persons:

The President: Herr Geheimer Regierungsrath Professor Dr. W. FOERSTER (Director of the Berlin Observatory).

The Director of the Society: Dr. MAX WILHELM MEYER.

Member on behalf of the Königliche Staats-Regierung: der vortragende Rath im K. Unterrichts-Ministerium Herr O. NEUMANN.
Herr Rentier A. TOST.



The direction of the work of construction was undertaken by Geheimer Oberregierungs-Rath Herr SPIEKER, by the authority of the Minister of Public Instruction. The designs for the building were perfected by Herr DITMAR, Landesbauinspektor, and the building erected in accordance with these plans by Herr ANDREE, Regierungsbaumeister. The accompanying photo-lithograph shows the principal façade of the completed building, and the various figures give the plans of the different stories. The institution was first opened to the public on July 2, 1889, and at the end of the year had been visited by not less than 60,000 persons.

The work of the institution is divided into five principal departments, the astronomical, physical, mechanical, microscopical, and the department of scientific lectures in connection with the auditorium, to which may be added the editorial management of the monthly journal. Each of these departments, with the exception of the mechanical, is under the supervision of a special official. The superintendent of the Astronomical Department is at present Dr. F. KÖRBER; the former superintendent, Dr. M. ZWINK, having accepted the position of Assistant in the Strassburg Observatory. With him are associated Herren ARCHENHOLD and SCHWAHN, and a number of younger astronomers, who assist with the telescopes on public evenings. The Physical Department is under the general direction of Professor E. GOLDSTEIN; Herr P. SPIES is superintendent, assisted by several younger physicists, who aid in instructing the public in the use of the instruments. The Microscopical Department is under the general direction of Professor W. PREYER, but the office of superintendent is as yet vacant. The auditorium is in charge of Herr W. KRANZ, who has the supervision of the scenic arrangements, machinery and apparatus connected with the public exhibitions. The more strictly business affairs of the Association are managed by Herr BRUCK. There are about thirty minor officials and employés in the different departments, so that some forty persons are engaged in carrying on the work of the institution, exclusive of the editorial staff of the journal.

I shall now endeavor to give a somewhat more detailed account of the equipment and work of the different departments. The principal instrument of the Astronomical Department, and the one which may be regarded as the main attraction of the establishment, is a twelve-inch refractor with objective by SCHOTT & Co. of Jena, which in Germany is only exceeded in size by the telescope at Strassburg. The figure of the glass, as well as the workmanship of the

mechanical parts of the mounting, appear from the tests we have been able to apply up to the present time to be of great excellence.

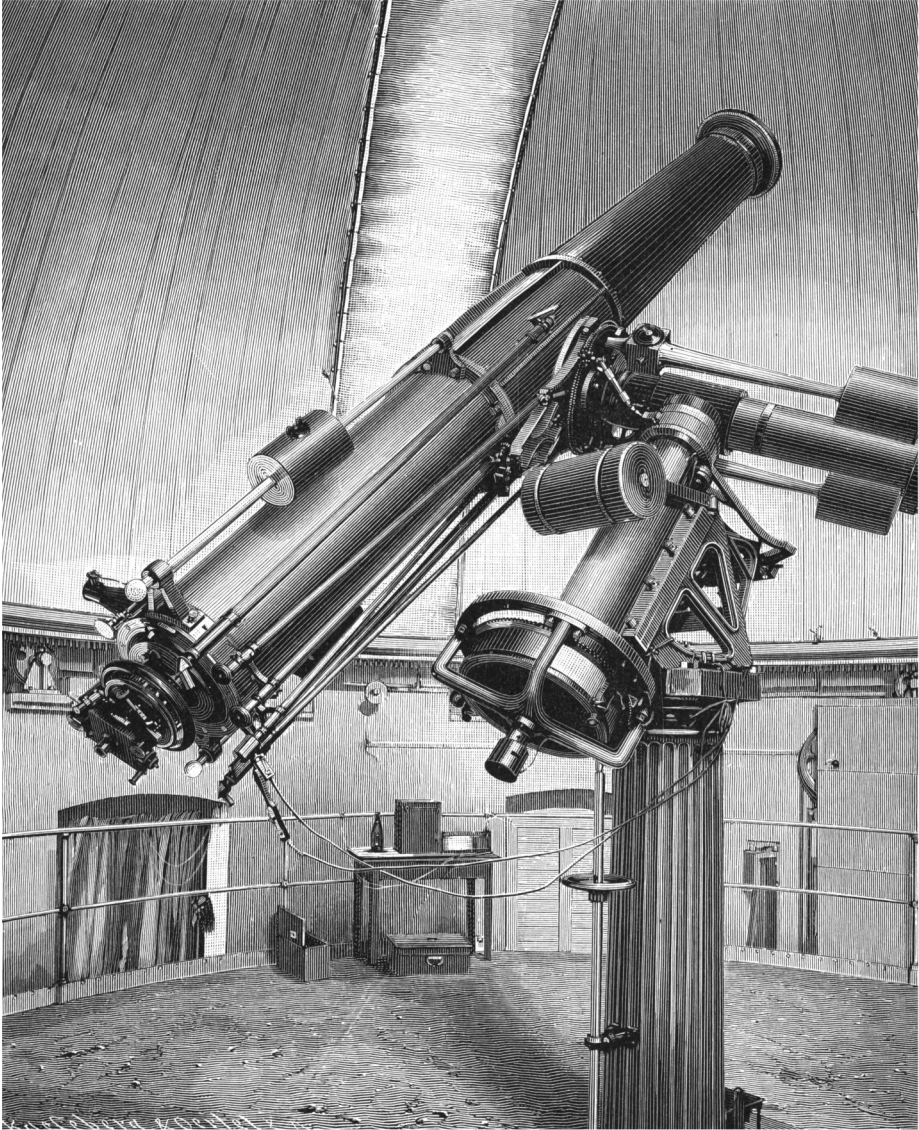
The instrument is provided with a filar micrometer, a polarizing helioscope, and a complete set of eye-pieces ranging in power from 70 to 1,300 diameters. Photographic and spectroscopic apparatus has not yet been supplied. Among the novel or interesting details of the attachments may be mentioned the electrical illumination of the circles and micrometer, and the electrical driving-clock, which is similar to the one used on the ten-inch refractor at Geneva. In this arrangement the current from a storage battery drives an electric motor attached to the clock-work, its power being regulated by a conical pendulum.

Since it is the object of our institution not only to exhibit natural phenomena and the workings of natural forces, but to illustrate the applications of mechanical and technical skill in their study, the latest mechanical devices have been employed in the equipment. The dome of the twelve-inch refractor, for example, is provided with a hydraulic elevating floor similar to the one in use at the Lick Observatory, capable of lifting twenty persons into the most convenient position for observation. The dome, twenty-six feet in diameter, is also rotated by hydraulic power, and the shutter closed by the same means. An arrangement will be added by which the rotation of the dome can be electrically controlled from the eye-end of the telescope.

The Urania Observatory has also five other telescopes. A six-inch refractor, with optical parts by REINFELDER and HERTEL and mounting by HEYDE, stands in the smaller dome, on the east. It is provided with clock-work and micrometer. In the west dome is a simple four-inch equatorial, also with clock-work. On the west platform, in the open air, but protected by canvas covers, are a six-inch reflector, with alt-azimuth mounting, and a two-and-a-half-inch transit instrument for time observations. On the east platform is an equatorially mounted comet-seeker of five inches aperture, the optical arrangements of which offer some peculiarities of construction. The objective is of Jena glass, with curves worked according to GAUSS' formula, the outer surface being concave. This combination gives a remarkably large field and great brilliancy.

The four last described instruments and the mechanical parts of the twelve-inch refractor are by CARL BAMBERG, of Friedenau, near Berlin.

The standard clock of the observatory, by TIEDE, stands in the vestibule of the large dome, and electrically controls two less perfect



clocks, one in each of the small domes. One of these in its turn controls a dial in the large dome. Electric connections extend from all parts of the observatory to a chronograph, on which the exact time of an observation can be recorded by means of the standard clock.

All these arrangements are of the latest and most improved designs, and have, of course, not been provided merely for the satisfaction of public curiosity, but for the prosecution of scientific research.

It is a well-known fact, which we have already been able to fully verify, that the great majority of visitors are not greatly edified by a view through a telescope. It is true that an observatory possesses a great attraction for the public; each person expects to see undreamed-of wonders in the worlds above us when he looks into an instrument. The disappointment is therefore very great when, for example, the brilliant light of the full moon has attracted crowds of visitors to the observatory, and it is necessary to explain to them that even the best telescopes show but little on the full moon, and that the most favorable time for observation is when the moon is near quadrature; or when they are shown a fixed star, and learn that the minuteness of the point of light seen in the telescope is owing to the immense distance of the suns scattered through space. Instructive articles in the papers setting forth these facts are of but little service. It is necessary to gradually modify the erroneous impressions of the public by a more thorough and striking method of instruction; and to this end we must pursue a proper course with our own astronomical workers, and give them opportunities to carry on actual scientific investigations. In this way only can they fully succeed in imparting a knowledge of the pleasure which arises from a comprehensive glance into the secrets of nature.

When, on account of the throngs that come to the observatory on clear evenings, the time allowed to each person is less than is required for a complete satisfaction of his wishes, and one is compelled to leave the telescope somewhat dissatisfied, we ask such a visitor to pass from the observatory itself into the auditorium, where instruction is given on the subject of the heavenly bodies, illustrated by means of views projected on a screen, by the aid of a light of 6,000 candle-power. From the mutual support of the two departments our visitors derive a pleasure which would otherwise be lost. In the first half year as many as 503 such lectures, each of half an hour's duration, were given in the auditorium, and a continually increasing collection of lantern slides, now about 700 in number, has been used in illustrat-

ing them. These lectures were not all, however, devoted to astronomy, but covered the various subjects within the scope of the institution.

The Physical Department is even more attractive to the visitors of Urania than the Astronomical, and this is largely due to the novel manner in which Professor GOLDSTEIN has arranged the apparatus. In all other museums and collections, handling the instruments is strictly forbidden; but here they are so contrived that the visitors, by touching an electric button, can set the machinery in motion. If, for example, the visitor presses a knob on the first case of the electrical collection, he sends a powerful current from the storage batteries through a spiral of platinum wire, by which the wire is heated to incandescence, and he is taught one of the simplest effects of the passage of an electric current through a resisting medium. The next case contains a somewhat similar piece of apparatus, but quite a number of different metals are acted on by the current. Another case illustrates the decomposition of water by electricity; another, the reverse of this process, the production of a current by chemical combination. In the same way are illustrated all the most important and interesting phenomena of electrical action, such as the magnetic effect of a coil transmitting a current, the mutual attraction or repulsion of currents and their inductive effects, as well as the operation of instruments based upon these principles.

Opposite to the electrical is the optical collection, where we find mirrors and lenses illustrating the formation of images; spectroscopes, with which the spectra of various substances can be examined at pleasure by pressing a knob; polariscopes, GEISSLER and CROOKES tubes, illuminated in the same manner, as well as a great number of other instruments.

The electric current which serves for these instruments and for the other purposes of the institution, is furnished by ten large storage batteries, which are charged by a dynamo, driven by a twelve-horse-power gas-engine in the cellar. From the storage batteries wires lead to all parts of the building. All the electrical machinery and connections were supplied by the firm of SIEMENS & HALSKE, of Berlin.

It is impossible to even mention the great number of instruments in the Physical Department, some of which, as, for example, those in the acoustical collection, excite great interest in the public. But we must make special reference to the phonograph, which, on account of its peculiar interest, is mounted in a room by itself. Unfortunately, this instrument, like a telescope, can be used by but one or at most a very few persons at a time, and it becomes necessary to admit vis-



itors in regular order, as at the telescopic exhibitions. Two complete phonographs, with many accessories (cylinders with musical pieces, etc.,) have been generously presented to the institution by Mr. EDISON, and the skill of our own physicists has largely increased the equipment. With these instruments special exhibitions are given, on certain evenings, at advanced rates.

After the Physical Department comes the Microscopical, introducing us to the wealth of animate and inanimate forms which surround us on every side, but which would be forever unknown to the unaided vision. We may regard the Physical Department as a connecting link between the Astronomical and the Microscopical, the whole bringing before our minds a true picture of nature, and teaching us what we are perhaps too apt to forget in contemplating the vast bodies dealt with by astronomy—that every infinitesimal particle of these is itself a world of wonders, whose place and purpose in forming the mighty whole of creation is hidden from all except Infinite wisdom.

Of the vast number of objects which offer the greatest instruction and entertainment under microscopical examination, only a few can be exhibited in the institution. Fifty compound microscopes, and many simple ones, are mounted in favorable situations in the building. In some of these are crystals showing the beautiful colors produced by polarized light; in others diatoms, low forms of animal life, parts of insects, and other preparations selected by Professor PREYER as best illustrating the variety of curious forms abounding in the land and sea. Among the interesting features of this department is a piece of apparatus which renders visible the development of the chick, the egg being warmed by electricity in a manner devised by Professor PREYER. Joining this department is a collection of scientific instruments by various makers in Germany, illustrating the most refined devices for exact measurements and physical investigations. These instruments are exhibited by permission of the institution, and are for sale.

The fifth department of our institution consists of the scientific theatre, or auditorium, and its adjuncts. The nature of the entertainments given here has been stated above. The stage, which has already been found somewhat too small for its purpose, is a copy on a small scale of the stages of our large theatres, with all the mechanical devices used in them, and was planned by Herr BRANDT, of the Royal Theatre of Berlin. The electric lighting is by SIEMENS & HALSKE, and the hydraulic machinery of the stage by C. HOPPE &

Co., who were also the builders of the dome for the twelve-inch equatorial.

It is evident that many additions to the ordinary outfit of a theatrical stage are required for the purposes of the Urania exhibitions. Since there are no actors, a floor is not ordinarily required, the lecturer standing at a small desk placed on one side, but it is placed in position for the lectures on experimental physics, the stage being then occupied by a long table. For exhibitions which are illustrated with lantern projections, the whole area occupied by the curtain is filled with a white screen, and the views are projected by a lantern having a 6,000 candle-power electric light at the other end of the room. The apparatus, by PLÖSSL & Co., of Vienna, is arranged to project opaque as well as transparent objects, microscopic preparations, and polariscopic and spectroscopic phenomena. For the present the short afternoon lectures that were given during the first half year of our existence have been discontinued, and longer entertainments are given in the evening. Two illustrated lectures prepared by the present writer, entitled "From the Earth to the Moon," and "The History of the Primeval World," have been repeated by Herr BERGMANN one hundred and twenty times. Other subjects have been "Light," "Heat," "Sound," "Electricity," "The Sun," "The Moon," "The Planets, Comets and Meteors," "Life in the Depths of the Ocean," "The Relations between Plants and Animals," and many others, drawn from the domains of physics, astronomy and biology.

Attention may be called here to the fact that our entertainments are not mere lectures, but are given with all due regard to spectacular effect, the assistance of the scenic artist and stage mechanician being called upon to supplement the work of the physicist or the astronomer. By this appeal to the senses of the spectator and his love of the beautiful and the striking, we believe it is possible to make a deeper impression than if the appeal were made to his intellect alone. In the "History of the Primeval World" the spectators see the gradual evolution of the earth from the chaos of the original nebula; they see the lightning and the eruptions, and hear the thunder of the tremendous struggle between fire and water as the earth gradually cools, and trace in the shifting scenery the changes which led up to its present peaceful condition.

Once or twice a week, more technical lectures, addressed to a smaller circle of hearers, are given, in place of the entertainments just described.

Instruction of a still higher grade is also given by the institution,

in the form of lessons on the use of astronomical and physical instruments, and the proper manipulation of the microscope, and lectures on these and other subjects will be given during the next winter.

In the basement of the building are the laboratories, and the machinery used for the various purposes of the institution, as will be seen on consulting the plan. Among the more important mechanical devices we may call especial attention to the gas-engine, which drives a dynamo for charging the storage batteries, and a force-pump for replenishing the hydraulic reservoirs; and to the machinery connected with the hydraulic apparatus for raising the floor and turning the dome of the large telescope. From here also starts the maze of water and gas pipes, electric cables and telephone wires which is spread throughout the building above.

We have found, with satisfaction, that the advantages offered by the various departments of *Urania* outlined above have been recognized by all classes of society. Over 60,000 persons visited the institution during the first half year of its existence, as has been said. Among these were a great number of students, in whose favor a reduction of half the regular price was made, and many teachers of the city schools, who are admitted free. School children under the care of their teachers have also been admitted, since the middle of November, three times a week, during the forenoon, and special entertainments are given every Sunday morning to workingmen at an entrance price of only twenty pfenninge (five cents). Various societies and corporations have secured the privilege of exclusive attendance during the afternoon hours on Sundays, and the doors are then not opened to the general public until three o'clock. The permanency of our institution is assured beyond doubt by this great and increasing popularity, and the satisfaction in its management that we are assured is felt by all becomes in the highest degree our own.

Since the foregoing article was put in type, the Report of *Gesellschaft Urania* for the past year has been received. From this interesting paper the following notes are taken: Since the opening of the institution to the public, visitors have been admitted on 268 days, and no less than 95,000 persons have availed themselves of the privilege. Among these must be counted 5,600 students, 7,900 members of various societies, 5,600 members of workingmen's societies, and 11,100 pupils from the city schools. The greatest number of visitors on any one day was 1,310. Three hundred and thirteen lectures of about ninety minutes long, and five hundred and eighty-two lectures of thirty minutes in length, have been given.

The receipts for the 268 days in question have been over \$26,000 (or about